NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA

THESIS

AN ANALYSIS OF PROMOTION TO 0-4 IN THE 1983 COHORT

by

Li-Wei Tu

March, 1996

Principal Advisor: Natalie J. Webb
Associate Advisor: Mike Cook

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	March, 1996	Master's Thesis

4. TITLE AND SUBTITLE AN ANALYSIS OF PROMOTION TO 0-4 IN THE 1983 COHORT	5. FUNDING NUMBERS
6. AUTHOR(S) Li-Wei Tu	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION/AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
Approved for public release; distribution is unlimited.	

13. ABSTRACT *(maximum 200 words)*

This thesis uses data from the 1983 cohort file merged with a college file obtained from the Defense Manpower Data Center (DMDC). This analysis focuses on the promotion rates of graduates of historically black colleges and universities (HBCUs). I estimate a model of promotion to LCDR 0-4 using a Maximum Likelihood Estimation (logistic) technique. I report the results using the "notional-person" approach; reporting the marginal effect of changes in the explanatory variables on promotion to LCDR.

Results of the study include: female promotion rates are higher than that of males', promotion rates are higher for graduates of aviation officer training programs than for graduates of military academies or ROTC programs, finally, promotion rates for officers who graduated from HBCUs are not significantly different than promotion rates for other officers.

14. SUBJECT TERMS Cohort, Promotion, ROTC, OCS, Logit Model, HBCU.	15. NUMBER OF PAGES 84
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18 298-102

Approved for public release; distribution is unlimited.

AN ANALYSIS OF PROMOTION TO 0-4 IN THE 1983 COHORT

Tu, Li-Wei, Major, Army of the Republic of China
B.S., National Defense Management College - 1986

Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN SYSTEMS MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
March 1996

ABSTRACT

This thesis uses data from the 1983 cohort file merged with a college file obtained from the Defense Manpower Data Center (DMDC). This analysis focuses on the promotion rates of graduates of historically black colleges and universities (HBCUs). I estimate a model of promotion to LCDR 0-4 using a Maximum Likelihood Estimation (logistic) technique. I report the results using the "notional-person" approach; reporting the marginal effect of changes in the explanatory variables on promotion to LCDR.

Results of the study include: female promotion rates are higher than that of males', promotion rates are higher for graduates of aviation officer training programs than for graduates of military academies or ROTC programs, finally, promotion rates for officers who graduated from HBCUs are not significantly different than promotion rates for other officers.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENT

I would like to express my sincere appreciation to my advisors Professor Natalie J. Webb and Professor Mike Cook for their willingness to share their priceless knowledge and insight with me in the preparation of this research; I would like to especially thank Professor Helen Davis for helping me with many SAS problems and to my friend, Lieutenant Commander Anthony Frabutt of the United States Navy, for helping in seeing this paper through to the end. I owe a special thanks to my loving wife Hui-Ying, for her countless hours of support and taking care of my daughter throughout this long endeavor and I am especially grateful to my parents, for helping me by taking care of my son in Taiwan.

I would like to present this thesis as a testament to their dedication and encouragement.

I. INTRODUCTION

A. BACKGROUND

Since 1974, defense drawdowns resulted in increasing concern for retaining the most qualified officers. It follows that promotion should reflect and be based on an individual's performance. Characteristics leading to increased probability of promotion should indicate a higher level of performance. Those who perform well should be more likely to be promoted. If the systems of promotion and retention are successful, then the most qualified officers should be more likely to remain on active duty.

Many studies have analyzed what characteristics determine an officer's chance of promotion to O-4. Historically, this is the first significant bottle-neck that an officer encounters in his or her career progression. It takes about ten years of commissioned service to attain this grade. Generally speaking, few studies focus on minority promotion, especially on attending historically black colleges and universities (HBCU).

B. RESEARCH QUESTIONS

The primary research question of this thesis is to identify which characteristics lead to higher probabilities of promotion. The thesis examines different factors in promotion rates, such as an officer's personal demographics, age, source of commission, race, education level, marital status, number of dependents, and the college attended, etc., and the relationship of these factors to promotion.

The second research question addresses the issue of promotion for officers who have graduated from HBCUs and their likelihood of being promoted to O-4.

C. SCOPE AND LIMITATIONS

This study uses two databases, a cohort data file and a college data file obtained from the Defense Manpower Data Center (DMDC). The study only addresses the probability of promotion to O-4 (Lieutenant Commander or Major) and the factors affecting promotion. Additionally, the study focuses on the effect on promotion of graduating from a HBCU.

D. ORGANIZATION

Following the introduction and background, Chapter II offers a review of the literature dealing with the issues of historically black college and university education, and discusses ROTC Programs. Chapter III presents a detailed description of the data employed and results of preliminary data analysis in the 1983 cohort data file, college and merged files, and then describes the methodology and sets up a Logit model. Chapter IV contains the analysis of the Logit model. Chapter V offers conclusions and recommendations based on the analysis.

II. BACKGROUND AND LITERATURE REVIEW

A. BACKGROUND

The majority of commission officers come into the services through the service academies, Reserve Officer Training Corps (ROTC), and Officer Candidate School (OCS).

This study focuses on Reserve Officers' Training Corps (ROTC). ROTC programs are offered by the Army, Navy (including Marine Corps), and Air Force in approximately 500 colleges and universities across the country. ROTC is a program designed to train and commission junior officers into the active and reserve components of the Armed Forces. Students who enroll in ROTC and qualify may receive financial assistance in exchange for active and reserve military service. ROTC consists of classroom academic courses, functional military training and field exercises, physical fitness and annual summer training of several weeks.

The Army ROTC was established in 1916. The ROTC commissions students as second lieutenants in the U.S. Army and is the Army's major source of college-trained officers. Both two- and four-year programs are available. Military obligation is incurred after successful completion of both a basic and an advanced ROTC course. In the 1983 cohort data file, there are 2434 officers (36.4%) from the total of 6696 in the Army population of the database whose source of commission is ROTC.

The Navy ROTC Program was established in 1926. The Naval Reserve Officers' Training Corp (NROTC) is a source of Regular Navy and Marine Corps Officers. In 1983 cohort, there were 934 officers (17.1%) from 5452 Navy population and 724 officers (38.9%) from 1860 Marine Corps population whose source of commission was NROTC.

The Air Force ROTC began in 1946 when the Air Force was established and offered the opportunity for a commission in the United States Air Force. An Air Force scholarship program (2-4 years) is available to full-time students who satisfy specific requirements. In 1983 cohort, there are 3698 officers (45.8%) from 8080 Air Force whose source of commission is ROTC (Statistical data from DMDC). [Ref. 1]

B. HISTORICALLY BLACK COLLEGES

Virtually, all of the historically Black Colleges and Universities are located in the Southern U.S. Appendix A lists 102 predominant Historically Black Colleges and Universities in 1996, by state. Figure 1 shows the distribution of Historically Black Colleges and Universities.

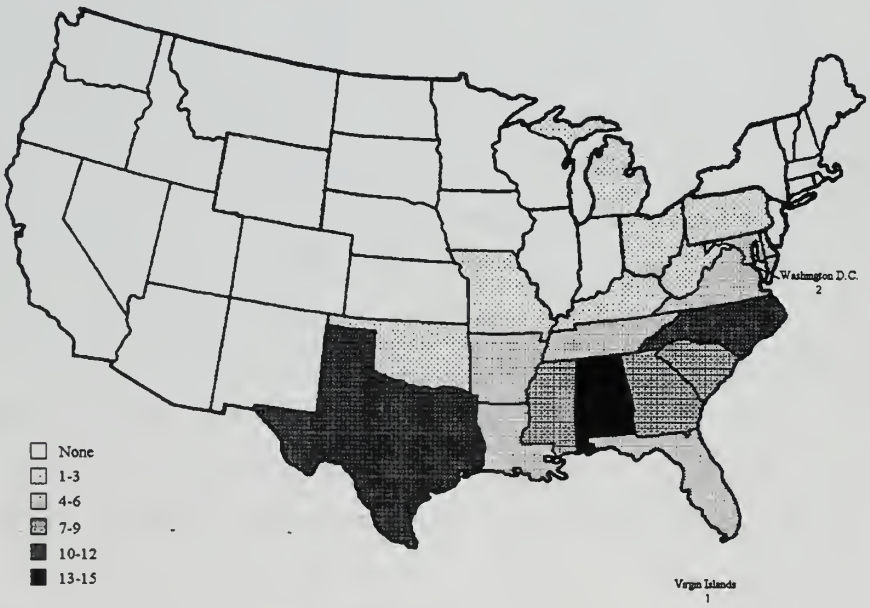

Figure 1. Distribution of Historically Black Colleges in 1996

1. The Role of the Historically Black Colleges and Universities

Black institutions have maintained their position as key suppliers of advanced education to Blacks and as producers of talented undergraduates for advanced study in all institutions.

Black colleges serve an additional function in meeting the needs of a defined cultural community and are essential elements of the educational system. Because federal/private foundation funds for research and development have largely been denied the nation's Black Colleges these schools are confronted with unique problems in administration and program priorities, which impact the production and distribution of black graduates. [Ref. 2]

Black colleges have had a greater influence than is represented by the number of their graduates. These colleges have developed primarily in the south under the pressures of segregation. Consequently, they are unique institutions and have had a disproportionately higher impact on the progress made by the Black population of the United States, both North and South.

2. Enrollment in Historically Black Colleges and Universities

Beginning in the mid-1960's, black students had access to more financial resources to attend colleges, both from their families and from government aid. In 1970's, non-traditionally black institutions were required to increase the number of black students and faculty on their campuses. Perhaps due to these trends, in the 1980's, total enrollment in traditionally black institutions declined slightly (3%) from 222,220 to 216,570.

Much of the decline in total enrollment can be attributed to a drop in freshmen enrollment. The number of first-time

freshmen declined 12 percent from 54,940 in 1980 to 48610 in 1982 [Ref. 4, p. 19].

3. Employment Opportunities for Graduates of Historically Black Colleges

The New York-based Hanigan Consulting Group reports that minority graduates received 23 percent more job offers than did whites even though they had 28 percent fewer job interviews. The average starting salary for minority graduates was $34,565, compared with $34,152 for white graduates in 1995.

A *Black Enterprise* story (relating a U.S. Office of Personnel Management (OPM)) report suggested 23 actions and innovative recruiting techniques to ensure that students get information about federal job opportunities early in their school years. The report also suggests initiatives to strengthen and forge new partnerships between the government and HBCU communities. *Black Enterprise* noted that most federal agencies have not recruited on HBCU campuses and surmised that ".... They believe they will not get the best recruits from HBCUs." There may be no foundation for this conclusion; indeed, HBCUs have produced three-fourths of all black officers in the Armed services [Ref. 6, p.29).

The *Black Enterprise* analysis says minority students received more job offers and higher starting salaries because they were better qualified than their white peers.

C. LITERATURE REVIEW

The Industrial and Labor Relations Review (ILR) uses data from the National Longitudinal Survey of the Class of 1972 to analyze the effect of attending historically black colleges and universities (HBCU) on future wages of black students [Ref. 8]. She found that although the pre-college

characteristics of students who attended HBCUs predicted lower wages than did the pre-college characteristics of students who attended mixed or historically white 4-year institutions, the value added in future wages from attending HBCUs was 38 percent higher than that from attending traditionally white or mixed institutions. [Ref. 8, p.531-546)

Loren M. Solnick examined the impact of attending a "black" college on the job success of a sample of black college graduates employed by a large manufacturing firm. He found that the graduates of black colleges start with higher salaries, but receive smaller wage increases and fewer promotions than comparable graduates of non-black colleges. [Ref. 9, pp. 135-148.)

John E. Lux's NPS thesis suggests that HBCUs may be a prime source of recruitment for "quality" officers, and that increasing recruitment at HBCUs may assist the armed forces in raising levels of black representation within the officer corps. [Ref. 10]

Peggy F. Simpson researched the promotion opportunities of minorities to the controlled grades in the Navy Nurse Corps. She found that minority status and gender are found to be statistically insignificant factor affecting promotion at the Captain and Commander selection levels (O-5, O-6); however, at the Lieutenant Commander (O-4) selection level, gender and minority status have a statistically significant negative effect on promotion. [Ref. 12]

D. SUMMARY

The literature cited above does not clearly describe the type of analysis this thesis employs. It does, however, provide a framework and theoretical basis for examining the

relationship between college resources and officer performance.

In the aggregate, given a minority member and a majority member who entered the military in 1971 completing their obligated service, having identical academic credentials, marital status, time in pay grade, discipline records, and occupational classifications, the minority member will be promoted at least as quickly as the majority member. This phenomenon reflects the emphasis the military has placed on minority advancement since 1972. [Ref. 11, p.90].

This study is to evaluate the relative impact of the current performance evaluations on minorities' and nonminorities' promotion rates. The performance evaluation model range for time in service is from twenty-four to fifteen years. The following in-service variables are statistically related to pay grade level: time in the service, discipline record, leadership and appearance evaluations and occupational classification. These factors are extremely important to an individual's promotion success. In the aggregate, there are few differences between race-ethnic groups' scores in leadership and appearance evaluations.

III. DATA AND METHODOLOGY

A. Preliminary Data Analysis

This thesis uses two databases, a 1983 cohort datafile, and a college datafile obtained from the databases of the Defense Manpower Data Center (DMDC). This chapter first presents an analysis of 1983 cohort data. The analysis uses data for:

- Sex (Male, Female)
- Source of Commission - Academy, Reserve Officer Training Corps (ROTC), Officer Candidate School (OCS), direct appointment professional, direct appointment non-professional, Aviation Training Program
- Race - White, Black, and other race (Hispanic, American Indian, Alaskan Native, Asian/Pacific Islander, and others).
- Education Level - college, masters, doctorate
- Age at Entry

Next this chapter introduces the college file and the file merged 1983 cohort file. The college file was obtained from DMDC. The merged file is analyzed with the above characteristics, focusing on HBCU graduates.

1. 1983 Cohort Data Analysis

In 1983 cohort data obtained from DMDC, there are 29,264 observations including Army (10,321, 35.3%), Navy (7,536, 25.8%), Air Force (2,233, 7.6%)and Marine Corps (9,174, 31.3%) data. The observations are yearly for all years between 1983 and 1994.

Data observations with rank below ensign (O-1) at entry into military service (in 1983) were deleted because the analysis concentrates on promotion from O-1 (ensign, or first lieutenant) to O-4 (lieutenant commander or major). All records where sex, race, or source of commission are unknown

were deleted. With the above deletions, the sample observations decreased from 29,264 to 16,520.

a. Specification of the Variables

In order to determine which environmental characteristics affect officers' performance and promotion, the thesis conducted a series of analyses involving a number of characteristics, such as sex, source of commission, race, education level, age at entry, and college attended. These variables are based on the 1983 cohort file. (When a variable is "yes" or "no", a value of "1" indicates the variable is "yes", otherwise it equals "0"). The variable descriptions are shown in Table 1. The means and standards deviations of these variables are shown in Table 2.

The age at which an officer enters military service may be an indication that this officer has more experience and could indicate that he/she is more likely to be promoted.

Most officers entering the military are between 21 and 25 as shown in Figure 2. This is an indication that most officers receive their commission via ROTC or OCS after college. Officers who entered service earlier (17-21) may have received their commissions from the military academies or may possibly be ex-enlisted members who obtained a college degree and were commissioned either through OCS or an Aviation Program. The majority of officers' source of commission was ROTC or OCS as shown in Figure 3.

The overwhelming majority are white as shown in Figure 4 with 90.94 percent, black 6.83 percent and other race are 2.23 percent. Because the majority of officers are white, the second question addressed in this study, whether HBCUs have an affect on the promotion rate to O-4, is based on less than 10 percent of the cohort data with even a smaller percentage of Black officers attending a HBCU.

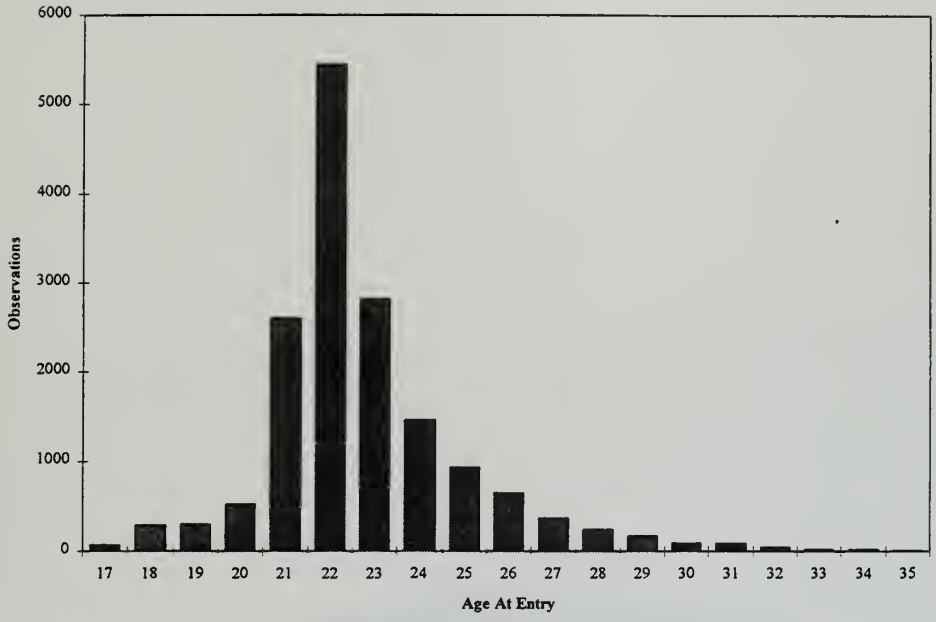

Figure 2. Distribution of Age of Entry

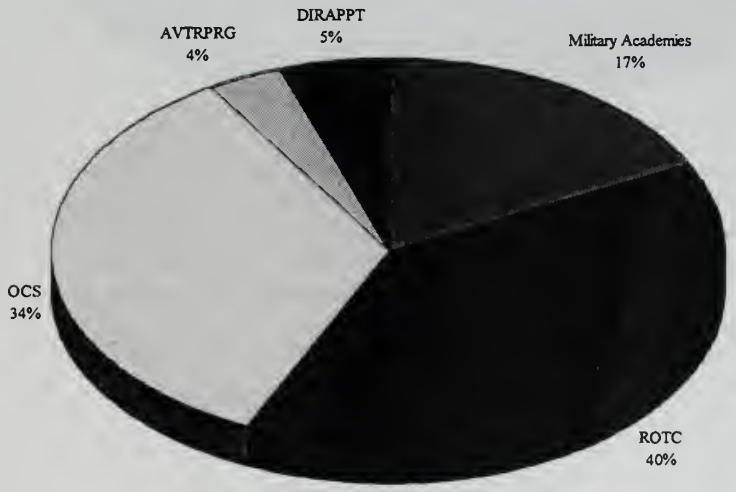

Figure 3. Source of Commission

Figure 4. Racial Makeup

PG83	Members' (officers) pay grade (rank) as of June 1983. O-1 is the lowest pay grade; O-11 is the highest
MALE	Male
FEMALE	Female
ACADEMY	Source of commission is military academy
ROTC	Source of commission is Reserve Officer Training Corps
OCS	Source of commission is Officer Candidate School
AVTRPRG	Source of commission is Aviation Training Program
DIRAPPT	Source of commission is Direct Appointment Professional & Non-Professional
WHITE	Individual is member of white race
BLACK	Individual is member of Black race
OTHER RACE	Individual is member of one of the following ethnic groups: Caucasian of Spanish descent, American Indian, Asian American, Puerto Rican, Filipino, Mexican American, Eskimo, Cuban American, Chinese, Japanese, Korean
COLLEGE	individual obtained college degree
MASTER	Individual obtained masters degree
DOCTOR	Individual obtained doctoral degree
E_AGE	Age at which individual entered the military
PROM	Pay grade equal 21 in 1983 and pay grade equal 24 after 1991 as dependent variable in Logic model

*All the above are dummy variables except the E_Age variable; if the event is true, then variable = 1, otherwise the variable = 0.

Table 1. Variable Descriptions

Variable	Label	N	Mean	Std Dev	Minimum	Maximum
MALE	MALE	16520	0.8739104	0.3319604	0	1.0000000
FEMALE	FEMALE	16520	0.1260896	0.3319604	0	1.0000000
ACADEMY	COM FM MIL SCHOOL	16520	0.1736683	0.3788354	0	1.0000000
ROTC	RES OFCR TRNG CORPS	16520	0.3949758	0.4888603	0	1.0000000
OCS	OFCR CANDIDATE SCHOOL	16520	0.3412833	0.4741546	0	1.0000000
AVTRPRG	AVN TRNG PROGRAM	16520	0.0384988	0.1924029	0	1.0000000
DIRAPPT	DIR APPT	16520	0.0515738	0.2211718	0	1.0000000
WHITE	RACE: WHITE	16520	0.9093826	0.2870730	0	1.0000000
BLACK	RACE: BLACK	16520	0.0683414	0.2523385	0	1.0000000
OTHER RACE	RACE: OTHER	16520	0.0222760	0.1475843	0	1.0000000
COLLEGE	BACHELORS DEGREE	16520	1.0000000	0	1.0000000	1.0000000
MASTERS	MASTERS DEGREE	16520	0.3004843	0.4584825	0	1.0000000
DOCTOR	DOCTORATE	16520	0.0041162	0.0640276	0	1.0000000
E_AGE	AGE AT ENTRY	16520	22.3900121	3.6724849	17	35.000000
PROM	PROMOTED TO 04 IN 94	16520	0.8573245	0.3497523	0	1.0000000

Table 2. Means and Standard Deviation of Variables

Sample Size	16520	100%	
Variables Total Sample			
Sex			
Male	14437	87.39%	
Female	2083	12.61%	
Source of Commission			
Military Academies	2869	17.37%	
ROTC	6525	39.50%	
OCS	5638	34.13%	
AVTRPRG	636	3.85%	
DIRAPPT	852	5.16%	
Race		0.00%	
White	15023	90.94%	
Black	1129	6.83%	
Other Race	368	2.23%	Hispanic, American Indian/Alaskan Native, Asian/Pacific Islander
Education			
College Degree	16520	100.00%	
Masters Degree	4964	30.05%	
Doctorate	68	0.41%	
Age at Entry			
17	76	0.46%	
18	297	1.80%	
19	304	1.84%	
20	534	3.23%	
21	2605	15.77%	
22	5448	32.98%	
23	2821	17.08%	
24	1474	8.92%	
25	940	5.69%	
26	660	4.00%	
27	378	2.29%	

Table 3. The Sample (16,520 Observations)

28	250	1.51%	
29	175	1.06%	
30	99	0.60%	
31	90	0.54%	
32	42	0.25%	
33	26	0.16%	
34	19	0.12%	
35	12	0.07%	

Table 3. The Sample (Continued)

b. The Male Sample Distribution

Table 4 indicates how the sample of male officers (14,437 observations) is distributed, by variable. The vast majority of officers commissioned in 1983 are male (87.39%).

Most male officers entering the military are between 21 and 25; 33.44 percent are 22 years of age. This means that a typical officer is a white male in his twenties who received his commission from ROTC or OCS after graduating from college.

Sample Size	14437	100%	
Variables Total Sample			
Source of Commission			
Military Academies	2658	18.41%	
ROTC	5656	39.18%	
OCS	5169	35.80%	
AVTRPRG	634	4.39%	
DIRAPPT	320	2.22%	

Table 4. The Male Sample (14,437 Observations)

Race		0.00%	
White	13287	92.03%	
Black	841	5.83%	
Other Race	309	2.14%	Hispanic, American Indian/Alaskan Native, Asian/Pacific Islander
Education			
College Degree	14437	100.00%	
Masters Degree	4299	29.78%	
Doctorate	64	0.44%	
Age			
17	72	0.50%	
18	277	1.92%	
19	294	2.04%	
20	494	3.42%	
21	2323	16.09%	
22	4828	33.44%	
23	2460	17.04%	
24	1293	8.96%	
25	818	5.67%	
26	555	3.84%	
27	303	2.10%	
28	196	1.36%	
29	123	0.85%	
30	62	0.43%	
31	66	0.46%	
32	26	0.18%	
33	21	0.15%	
34	6	0.04%	
35	5	0.03%	

Table 4. The Male Sample (Continued)

c. The Female Sample Distribution

Table 5 indicates how the sample of female officers (2,083 observations) is distributed, by variable. Most female

officers entering the military are between 21 and 24; 29.76 percent are 22 years of age.

Female officers make up 12.6 percent of the sample. Of note in Table 5 is that the percentage of Black female officers (13.83%) is more than double the percentage of Black male officers (6.83%).

d. The Black Sample Distribution

Table 6 indicates how the sample of Black officers (1,129 observations) is distributed, by variable. Of note in Table 6 is that the percentage of blacks with Masters Degrees is higher than white or male samples. However, shown in Table 5, the female sample is the highest percentage of Masters Degrees.

e. The White Sample Distribution

Table 7 indicates how the sample of white officers (15,024 observations) is distributed, by variable. The white sample distribution is the typical commissioned officer.

f. The Other Race Sample Distribution

Table 8 indicates how the sample of Other Race officers (368 observations) is distributed, by variable. This sample is the smallest group and has the highest percentage of Doctorates. However, this is based only on two observations.

Sample Size	2083	100%	
Variables Total Sample			
Source of Commission			
Military Academies	211	10.13%	
ROTC	869	41.72%	

Table 5. The Female Sample (2,083 Observations)

OCS	469	22.52%	
AVTRPRG	2	0.10%	
DIRAPPT	532	25.54%	
Race			
White	1736	83.34%	
Black	288	13.83%	
Other Race	59	2.83%	Hispanic, American Indian/Alaskan Native, Asian/Pacific Islander
Education			
College Degree	2083	100.00%	
Masters Degree	665	31.93%	
Doctorate	4	0.19%	
Age			
17	4	0.19%	
18	20	0.96%	
19	10	0.48%	
20	40	1.92%	
21	282	13.54%	
22	620	29.76%	
23	361	17.33%	
24	181	8.69%	
25	122	5.86%	
26	105	5.04%	
27	75	3.60%	
28	54	2.59%	
29	52	2.50%	
30	37	1.78%	
31	24	1.15%	
32	16	0.77%	
33	5	0.24%	
34	13	0.62%	
35	7	0.34%	

Table 5. The Female Sample (Continued)

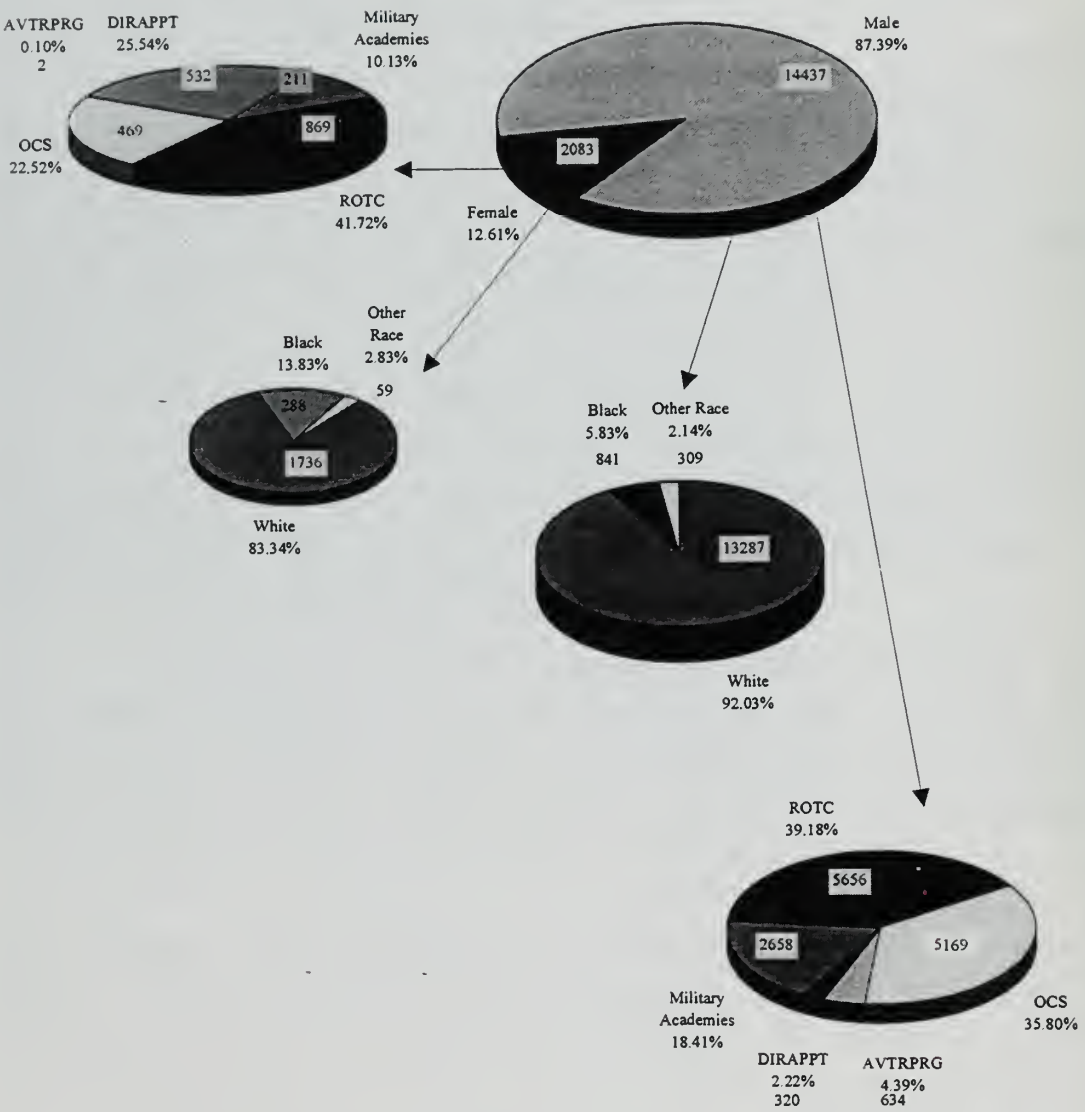

Figure 5. The Distribution of Male/Female

Sample Size	1129	100%	
Variables Total Sample			
Source of Commission			
Military Academies	139	12.31%	
ROTC	642	56.86%	
OCS	240	21.26%	
AVTRPRG	15	1.33%	
DIRAPPT	93	8.24%	
Education			
College Degree	1129	100.00%	
Masters Degree	350	31.00%	
Doctorate	1	0.09%	
Age			
17	4	0.35%	
18	15	1.33%	
19	19	1.68%	
20	34	3.01%	
21	147	13.02%	
22	367	32.51%	
23	214	18.95%	
24	115	10.19%	
25	59	5.23%	
26	44	3.90%	
27	27	2.39%	
28	22	1.95%	
29	23	2.04%	
30	6	0.53%	
31	8	0.71%	
32	9	0.80%	
33	1	0.09%	
34	1	0.09%	
35	4	0.35%	

Table 6. The Black Sample (1,129 Observations)

Sample Size	15023	100%	
Variables Total Sample			
Source of Commission			
Military Academies	2630	17.51%	
ROTC	5749	38.27%	
OCS	5305	35.31%	
AVTRPRG	607	4.04%	
DIRAPPT	732	4.87%	
Education			
College Degree	15023	100.00%	
Masters Degree	4505	29.99%	
Doctorate	65	0.43%	
Age			
17	71	0.47%	
18	281	1.87%	
19	277	1.84%	
20	487	3.24%	
21	2384	15.87%	
22	4966	33.06%	
23	2545	16.94%	
24	1334	8.88%	
25	859	5.72%	
26	599	3.99%	
27	345	2.30%	
28	221	1.47%	
29	148	0.99%	
30	91	0.61%	
31	77	0.51%	
32	31	0.21%	
33	25	0.17%	
34	18	0.12%	
35	8	0.05%	

Table 7. The White Sample (15,023 Observations)

Sample Size	368	100%	
Variables Total Sample			
Source of Commission			
Military Academies	100	27.17%	
ROTC	134	36.41%	
OCS	93	25.27%	
AVTRPRG	27	7.34%	
DIRAPPT	14	3.80%	
Education		0.00%	
College Degree	368	100.00%	
Masters Degree	109	29.62%	
Doctorate	2	0.54%	
Age at Entry			
17	1	0.27%	
18	1	0.27%	
19	8	2.17%	
20	13	3.53%	
21	74	20.11%	
22	115	31.25%	
23	62	16.85%	
24	25	6.79%	
25	22	5.98%	
26	17	4.62%	
27	6	1.63%	
28	7	1.90%	
29	4	1.09%	
30	2	0.54%	
31	5	1.36%	
32	2	0.54%	
33		0.00%	
34		0.00%	
35		1.09%	

Table 8. The Other Race Sample (368 Observations)

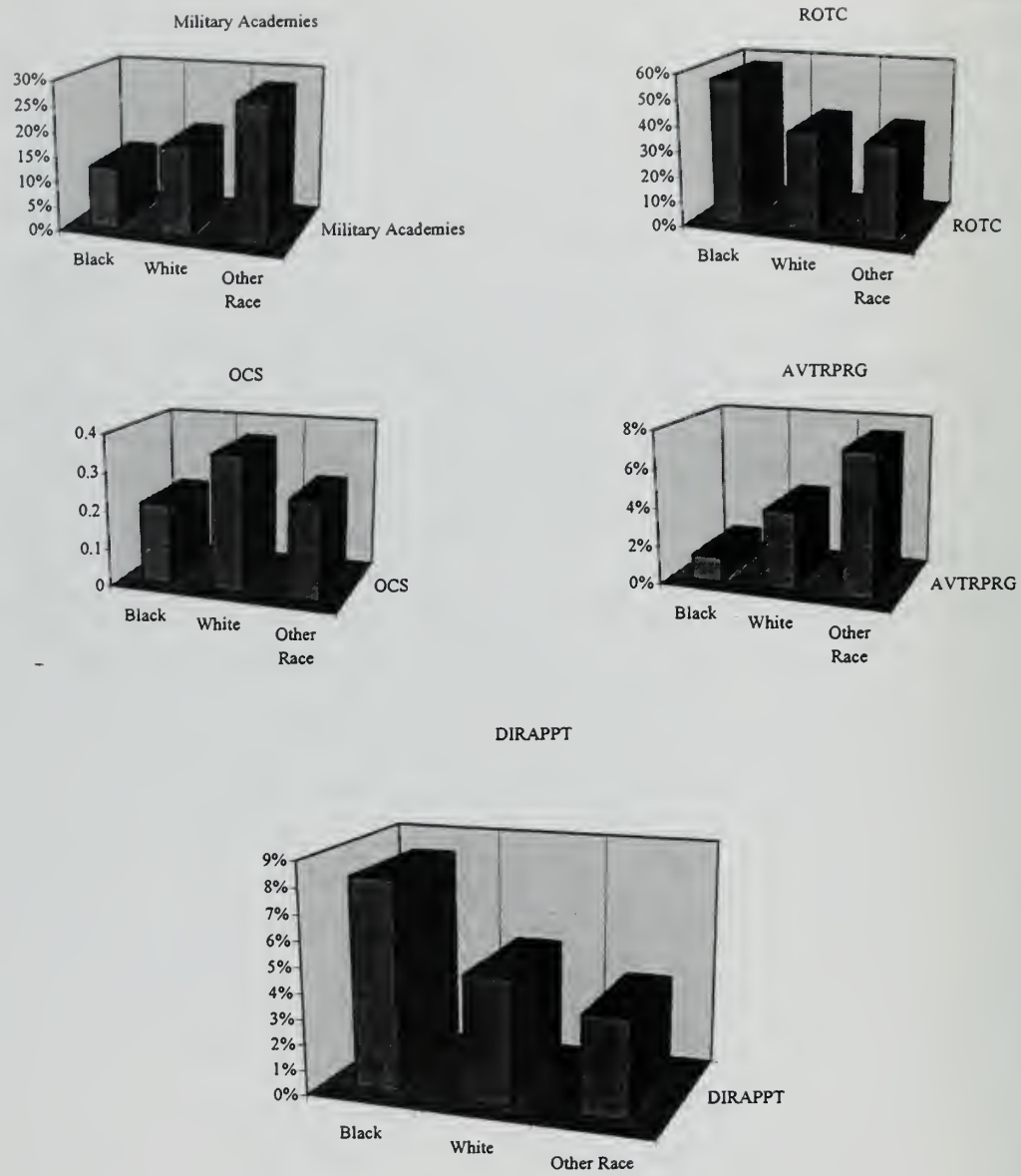

Figure 6. The Distribution of Race and Source of Commission

g. The Promotion from O-1 to O-4 Sample Distribution

Table 9 and Figure 7 indicate how the sample of officers (16520 observations) is distributed, by variable, for officers promoted to O-4.

2. 1994 College Data and Merged Data Analysis

In the college file, two variables are used to merge the file with the 1983 cohort file: Social security number (SSN), and college attended. (coding is shown Appendix C.) DMDC provided the Historically Black College and University coding (coding shown Appendix D).

Sample Size	16520	2357	14.27%	Of the 16,520 officer who were O1 in 1983, 2357 were promoted to O4 in 1994. (Promotion Rate of 14.3%)
Variables Total Sample				
Source of Commission				
Military Academies	2869	410	14.29%	
ROTC	6525	917	14.05%	
OCS	5638	702	12.45%	
AVTRPRG	636	130	20.44%	
DIRAPPT	852	198	23.24%	
Sex				
Male	14437	2018	13.98%	
Female	2083	339	16.27%	
Race				
White	15023	2158	14.36%	
Black	1129	155	13.73%	
Other Race	368	44	11.96%	
Education				
College Degree	16520	2357	14.27%	
Masters Degree	4964	1224	24.66%	
Doctorate	68	22	32.35%	

Table 9. The Officer Promotion Rate O-1 to O-4 Sample (16,520 Observations)

Age				
17	76	14	18.42%	
18	297	38	12.79%	
19	304	33	10.86%	
20	534	70	13.11%	
21	2605	384	14.74%	
22	5448	823	15.11%	
23	2821	357	12.66%	
24	1474	192	13.03%	
25	940	133	14.15%	
26	660	88	13.33%	
27	378	55	14.55%	
28	250	50	20.00%	
29	175	24	13.71%	
30	99	31	31.31%	
31	90	21	23.33%	
32	42	13	30.95%	
33	26	4	15.38%	
34	19	7	36.84%	
35	12	3	25.00%	

Table 9. The Officer Promotion Rate O-1 to O-4 Sample (Continued)

In the following section, an analysis of the merged data. All records where race was unknown were deleted, along with data where the rank was not O1 in 1983. Finally, officers who separated before 1994 were deleted. This was done in order to successfully merge 1983 cohort and the college files.

These data adjustments were made to analyze the promotion rate of officers (7,718 observations) who were still in the military in 1994.

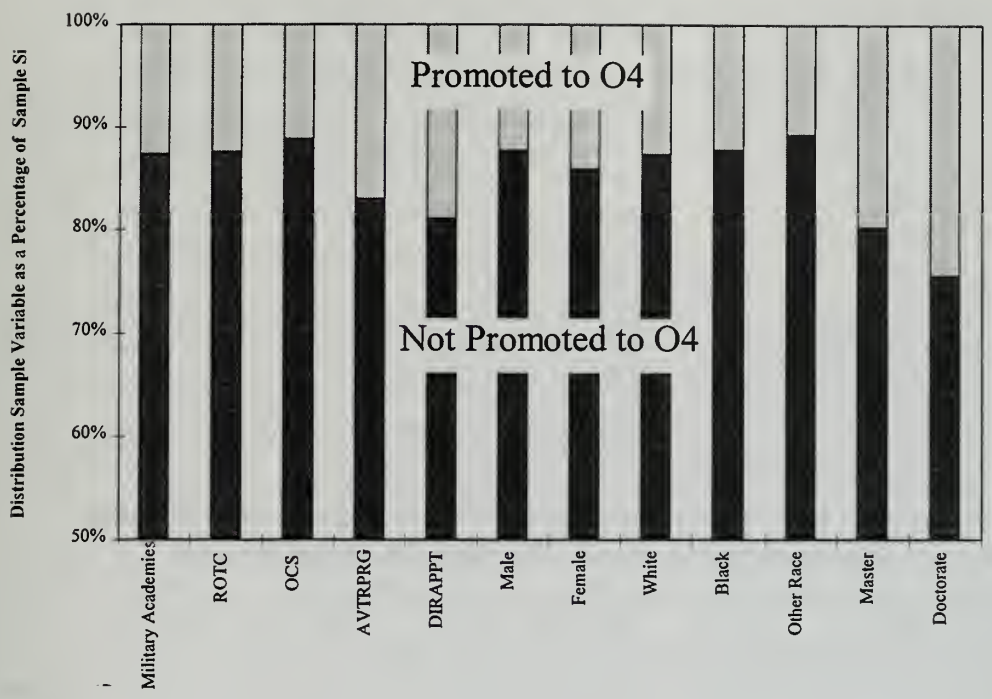

Figure 7. The Officer Promotion Rate to O-4

Three other variables were created as follows:

- HBC: officers who graduated from Historically Black Colleges and Universities
- BHBC: black officers who graduated from HBCs
- WHBC: white officers who graduated from HBCs
- OHBC: other race officers who graduated from HBCs

a. Merged Sample Distribution

The sample distribution for each of the above variables is shown in Table 10.

Sample Size	7718	100.00%	
College Attended			
HBC	119	1.54%	
Non-HBC	7599	98.46%	
Race			
White	6931	89.80%	
HBC	45	0.58%	
Black	606	7.85%	
HBC	72	0.93%	
Other Race	181	2.35%	
HBC	2	0.03%	

Table 10. The Distribution of Officers in the Merged Data Base (7,718 Observations)

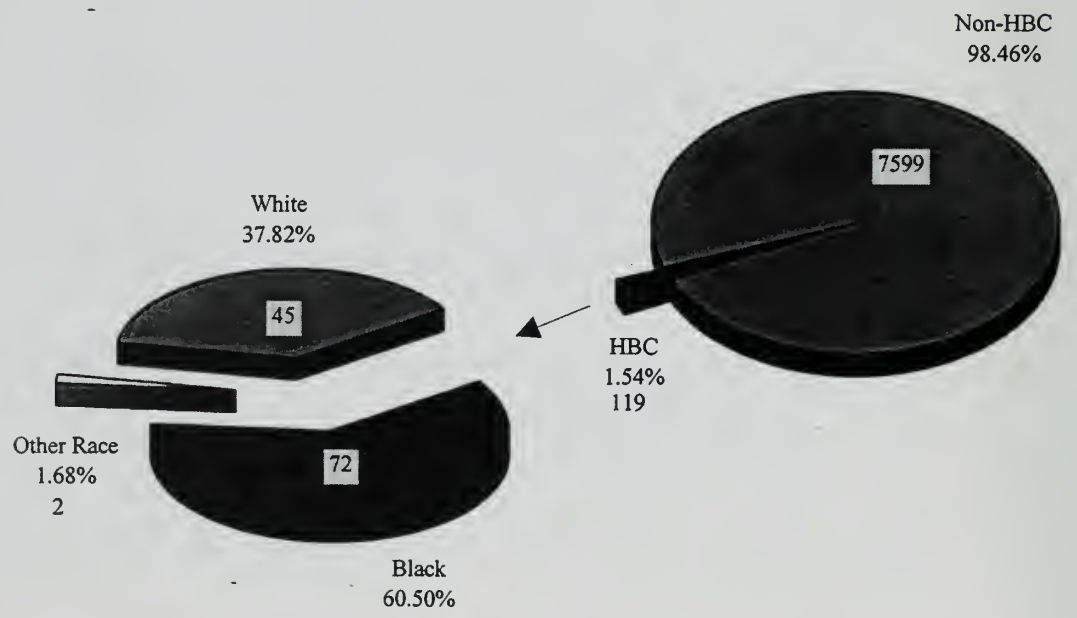

Figure 8. The Distribution of Officers in the Merged Data Base (7,718 Observations)

b. The Promotion from O-1 to O-4 Merged Sample Distribution

Table 11 indicates how the sample of officers (7,718 observations) is distributed, by variable for officers promoted to O-4.

Sample Size	7718	3100	40.17%	Of the 7718 officer who were O1 in 1983, 3100 were promoted to O4 in 1994. (Promotion Rate of 40.2%)
Race				
White	6931	2823	40.73%	
HBC	45	27	60.00%	
Black	606	220	36.30%	
HBC	72	24	33.33%	
Other Race	181	57	31.49%	
HBC	2	0	0.00%	
HBC	119	51	42.86%	

Table 11. The Officer Promotion Rate to O-4 for Merged Data (7,718 Observations)

B. METHODOLOGY

1. Choice of Method

Multiple regression analysis is a valuable statistical technique. It shows the impact of incremental changes in a defined explanatory (independent) variable on a dependent variable, holding all other independent variables constant.

This thesis uses the Logit model and notional person approach analysis. These methods offer calculated changes in the probability of the effect on the dependent variable, and predicted probabilities. Additionally, they minimize the effects of heteroscedasticity.

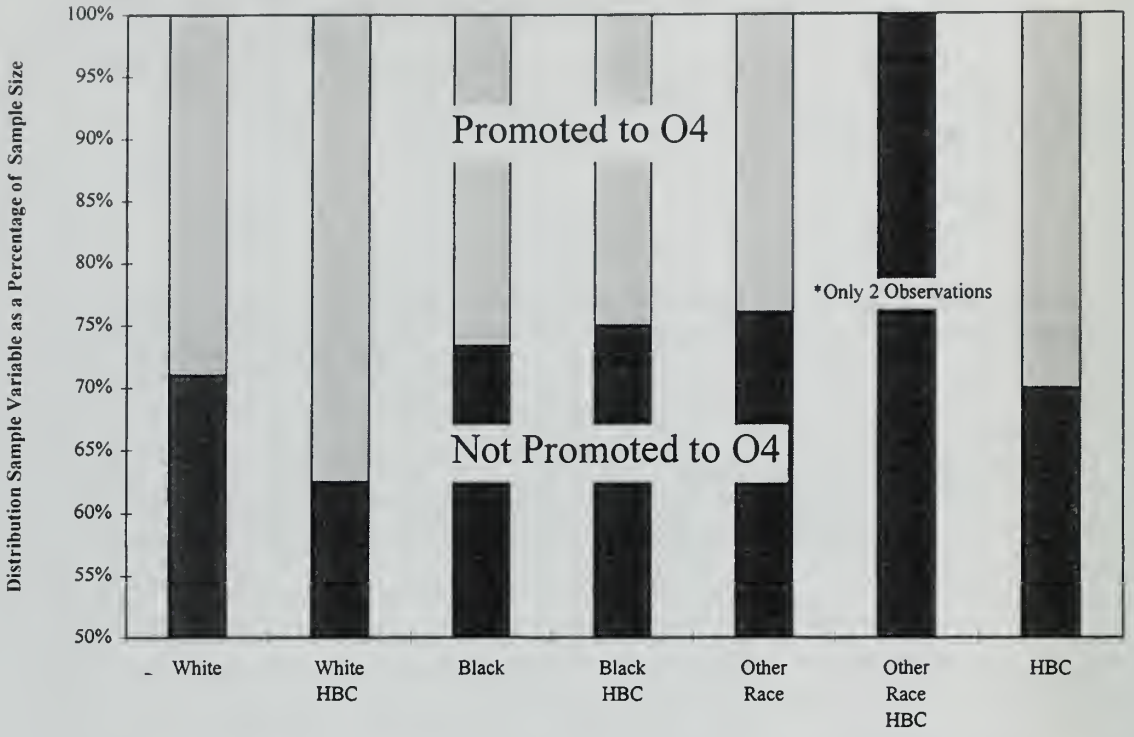

Figure 9. The Officer Promotion Rate to O-4

In the Logit model, the dependent variable is a dichotomous dummy variable, promoted (=0) or fails to be promoted (=1).

The assumed relationship is:

$$P_i = E\left(Y=\frac{1}{X_i}\right) = \frac{1}{1+e^{-(\beta_1+\beta_2 X_i)}} \qquad (1)$$

where:

P_i is the probability that an individual is promoted, given the personal attributes X_i,

X_i represents data base values for each of the explanatory variables in the model,

e is the base of the natural logarithm,

β represents values of the estimated parameters provided by the Logit Model,

i is the number of explanatory variables in the model.

For estimation purposes, the logarithm is written as:

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_1+\beta_2 X_i \qquad (2)$$

where:

L_i is the log of the odds ratio (Logit),

P_i is the probability that an individual is promoted, given the personal attributes X_1,

X_i is the vector of independent variables for the ith observation,

β_1 is the intercept,

β is the coefficient of the regression parameters,

i is the number of explanatory variables in the model.

This regression gives the estimated slope (β), which measures the change in L for a unit change in X. It tells how the log-odds in favor of promotion change as X changes by a unit. The log-of-the-odds ratio is not only linear in X but also linear in the parameters.[Ref. 13]

The software used was the LOGIT procedure in the Statistical Analysis Software (SAS) package. Logistic regression is widely used to predict probability.

2. Multivariate Logistic Regression Model

The empirical model used to find predicted probabilities on officer promotion (using the Logit model and cohort data) is:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1(Female) + \beta_2(Academy) + \beta_3(ROTC) + \beta_4(AvTrPrg) + \beta_5(DirAppt) + \beta_6(Black) + \beta_7(OtheRace) + \beta_8(Master) + \beta_9(E\_Age) \quad (3)$$

The maximum-likelihood chi-square statistic measures the confidence of the parameter estimates. The chi-square statistic derived from dividing the parameter estimate by its standard-error and squaring the result. The probability of exceeding that chi-square statistic through random chance indicates whether the variable may be accepted or rejected for a given significance level.

The empirical model examining only graduates of HBCUs is:

$$\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1(Female) + \beta_2(Academy) + \beta_3(ROTC) + \beta_4(AvTrPrg) + \beta_5(DirAppt) + \beta_6(Black) + \beta_7(OtheRac + \beta_8(Master) + \beta_9(E\_Age) + \beta_{10}(HBC) \quad (4)$$

3. Notional Person Analysis

The notional person approach defines a "notional" person to determine the overall promotion probability. The change in probability associated with any given independent variable can then be calculated for this "notional" person. The sign on the "YHAT" estimate indicates whether the variable is associated with an increase or decrease in the probability of selection.

$$\hat{Y} = Probility\ of\ Promotion =$$
$$\beta_0 + \beta_1(Female) + \beta_2(Academy) + \beta_3(ROTC)$$
$$+ \beta_4(AvTrPrg) + \beta_5(DirAppt) + \beta_6(Black) \quad (5)$$
$$+ \beta_7(OtheRace) + \beta_8(Master) + \beta_9(E\_Age)$$
$$+ \beta_{10}(HBC)$$

The notional person method is used to evaluate the effect of a single explanatory variable on the probability of promotion. This is done by setting all the explanatory variables to their mean value. In the case of the dummy variables Females through Master, this value is set to zero and for the continuous variable E_Age this value is set to the mean age of 22.15 years. Each variable is independently tested by increasing it by one and the effect of that variable on the probability of promotion is gauged by subtracting the result of this change from the result with all variables set at the mean.

IV. ANALYSIS

A. 1983 COHORT DATA

1. Analysis

This Section focuses on 16,520 sample observations. There are 14,437 (87.4%) males and 2,083 (12.6%) females. The most common source of commissioning is the Reserve Officer Training Corps, accounting for 39.5 percent of the sample. Over ninety percent of observations represent white officers; officers of black and other races are 6.8 percent and 2.2 percent of the sample, respectively.

The results of this analysis are:

- The promotion rate to O-4 of possessing master degree is significant.
- The promotion rate to O-4 of males is greater than females'.
- The promotion rate to O-4 of graduates from military academy school is greater than the other source of commission's.
- The promotion rate to O-4 of age of entering military is significant.
- The promotion rate to O-4 of white officers is greater than black officers, and graduating from HBCU is not significant in 1983 cohort.

a. Master and Doctorate Degrees

Thirty percent of officers received masters degrees before 1994, and 0.4 percent of officers received doctorate degrees. Theoretically, higher education should lead to a higher probability of promotion. The following Logit model confirms this hypothesis.

The percentage of females with masters degree is 31.93 percent, and greater the males' percentage (29.78%); yet there are 0.44 percent males with doctorate degree and only 0.19 percent of females have doctorates.

In the distribution of education there are 31 percent of Blacks with master degrees this is higher than whites (29.99%). Blacks with doctorates is 0.09 percent which is lower than the whites (0.43%).

Of note is that 29.62 percent of other races have master degree and 0.54 percent have doctorate degree which is the highest percentage of the sample.

It can be inferred that the promotion rate of officers having doctorate degrees is greater than for those who have master degrees. However, considering the sample size, 68 doctorates, the perception may be untrue and the doctorate and masters degree group may simply have a higher performance level which leads to a higher promotion rate. The percentage of promotion rate for officers possessing doctorates degrees is 32.35 percent , greater than those who possess only master degrees (24.66%).

b. Promotion Rate

From the data we can see that the females' promotion rate (16.27%) is higher than the males' (13.98%).

c. Military Aacademy

The percentage of males from military academies is 18.41 percent while the percentage of females is 10.13 percent. The promotion (to O-4) rate of the sample is 14.3 percent. For Direct Appointment officers it was 23.24 percent (the highest). Aviation Training Program accounted for 20.44 percent. Military academies was 14.29 percent with RTOC was 14.05 percent.

d. Black and White Promotion

Generally speaking, the promotion rate of whites was (14.36%) and is greater than Blacks(13.73%) this is only a small difference (0.63%). On the other hand, the rate for other races is the lowest (11.96%).

2. Logit Model Result Analysis

In accordance with established procedures for constructing a LOGIT model, a "base case" was chosen to provide a reference point from which to determine probabilities for the remaining variables. The base case variables chosen are "MALE", "OCS", "WHITE," and "COLLEGE." From SAS output (Table 12), an analysis of Maximum Likelihood Estimates indicates that several variables have a positive influence on the probability of promotion.

Variable	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square	Standard Estimate	Odds Ratio
INTERCEPT	-3.1274	0.1690	342.6301	0.0001		0.044
FEMALE	0.00615	0.0715	0.0074	0.9315	0.001125	1.006
ACADEMY	0.2398	0.0691	12.0354	*0.0005	0.050092	1.271
ROTC	0.2015	0.0559	12.9765	*0.0003	0.054296	1.223
AVTRPRG	0.8765	0.1095	64.0740	*0.0001	0.092976	2.402
DIRAPPT	0.8441	0.1000	71.1875	*0.0001	0.102932	2.326
BLACK	-0.1157	0.0930	1.5481	0.2134	-0.016095	0.891
OTHERACE	-0.2709	0.1665	2.6476	0.1037	-0.022042	0.763
MASTER	1.1485	0.0462	619.0448	*0.0001	0.290304	3.153
E_AGE	0.0305	0.00698	19.1310	*0.0001	0.061806	1.031

Chi-Square = 725.029 with 9 degrees of freedom.
*=Significant at a 99 percent confidence level.

Table 12. Logistic Procedure

Only three variables (FEMALE , BLACK, OTHERACE) are not significant (at the 0.01 level of significant or better). The variables ACADEMY and ROTC, are positive and significant at the 0.01 level. This indicates that source of commission from Academy and ROTC increases the likelihood of promotion to O-4.

The variables AVTRPRG AND DIRAPPT, are also positive and highly significant. This indicates that the Aviation Training

Program commission and a Direct Appointment commission increase the likelihood of promotion to O-4.

The variable master is significant at the 0.01 level, and positive. This indicates that possession of a master's degree increases the likelihood of promotion.

Finally, age at entry is positive and significant at level 0.01 significant level. This indicates that age at entry to the military increases the probability of promotion.

3. Notional Person Result Analysis

The "notional person" has 7.9 percent likelihood of being promoted to O-4. The promotion rate increases 0.045 percent if one changes the unit of female. Increasing one unit of Academy and ROTC observation increases the promotion rate 1.9 percent and 1.6 percent, respectively. Increasing of Aviation Training Program and Direct Appointment Officer one unit increases the promotion rate to 9.2 percent and 8.7 percent, respectively. On the other hand, if a one unit increase in Blacks and other race, decreases the promotion rate by 0.8 percent and 1.7, percent respectively. The promotion rate increases 13.4 percent for a one unit increase in master's degree observation. If the age of the officer at the time of commission in entry year is older by one, the probability of promotion to O-4 increases 0.2 percent. This means that people with experience and maturity are promoted at a higher rate. Although the military is a fairly youthful organization. Table 13 shows the results of the "notional person approach". The classification table is in Appendix E.

Variable	Marginal Effect
FEMALE	+0.718
ACADEMY	+0.019
ROTC	+0.016
AVTRPRG	+0.092
DIRAPPT	+0.088
BLACK	-0.008
OTHERACE	-0.018
MASTER	+0.134
E_AGE	+0.002

Table 13. Notional Person Analysis

B. MERGED DATA ANALYSIS

1. Frequency Result Analysis

This section presents an analysis of the merged data. Observations in this dataset represent officers (7,718) who remained in military from 1983 until 1994. The analysis examines frequency and promotion rates of officers who graduated from Historically Black Colleges and Universities in the 1983 cohort.

From the data, 6,931 observations represent whites, 606 represent blacks and 119 observations graduated from a HBCU. 45 white officers (0.65 percent white) graduated from a HBCU, and 72 blacks graduated from a HBCU.

It must be understood that HBCU students are not a large group recruited into the military. Selection bias that results is discussed in the next chapter.

2. The Result of Logit Model

This is the same model as the previous Logit model reported in Table 12 with two changes. First, the model is estimated on the merged data and all observations without a

valid response for college attended was omitted. Second, an indicator variable, HBC is defined where HBC = 1 if the individual graduated from a historically black college or university and equal to zero if the individual graduated from any other college or university. The model estimated is:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1(HBC) + \beta_2(Female) + \beta_3(Academy) + \beta_4(ROTC) + \beta_5(AvTrPrg) + \beta_6(DirAppt) + \beta_7(Black) + \beta_8(OtheRace) + \beta_9(Master) + \beta_{10}(E\_Age) \quad (6)$$

The results from this Logit model are reported in Table 14. The main variable of interest is the parameter estimate for HBC. Graduating from a HBC does not have a statistically significant affect on an officer's probability of promotion. The results for all of the other control variables are reported in Table 12 as well.

Variable	DF	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square	Standard Estimate	Odds Ratio
INTERCEPT	1	-1.0078	0.1150	76.7577	0.0001		0.365
HBC	1	-0.0567	0.1976	0.0824	0.7741	-0.003852	0.945
FEMALE	1	0.5463	0.0780	49.1094	*0.0001	0.093469	1.727
ACADEMY	1	-0.4418	0.0708	38.8905	*0.0001	-0.089770	0.643
ROTC	1	-0.2793	0.0540	26.7880	*0.0001	-0.073555	0.756
AVTRPRG	1	3.0217	0.3668	67.8652	*0.0001	0.216015	20.527
DIRAPPT	1	0.9535	0.1320	52.1436	*0.0001	0.103701	2.595
BLACK	1	-0.0002	0.1024	0.0000	0.9984	-0.000026226	1.000
OTHERACE	1	-0.5097	0.2143	5.6590	*0.0174	-0.033756	0.601
MASTER	1	-0.1854	0.0483	14.7300	*0.0001	-0.051045	0.831
E_AGE	1	0.0342	0.00496	47.4766	*0.0001	0.096799	1.035

Chi-Square = 466.047 with 10 degrees of freedom.
*=Significant at a 99 percent confidence level.

Table 14. Analysis of Maximum Likelihood Estimates

While most of the results are consistent with previous results, there are a few results that appear to contradict the results from the previous Logit. Whereas in the previous model both ACADEMY and ROTC had a significant positive effect on promotion, in this model both of these variables have a significant negative effect on promotion. This may suggest that the assumption that promotion behavior in the merged sample is similar to the promotion behavior in the complete sample is mistaken. Future research should focus on improving the data on an officer's college attended.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The purpose of the military promotion system is to keep adequate numbers of qualified officers in every pay grade, and available to fill vacancy positions in the military hierarchy. The system should reward high performing officers with promotions to higher positions of authority and increased responsibility. This study investigates the determinants of promotion in the U.S. Military.

Black colleges and universities, despite limited resources, have performed a necessary service to the black communities and to the country. Without them the educational and occupational gaps between blacks and whites in this country would be much greater than they are now.

This thesis investigates the effect of attending a HBCU on promotion to O-4 in the U.S. Military. It also investigates the effect of various other characteristics on promotion. A discussion of the results of the analysis follows:

As expected, this study found that the promotion rate of males (13.98%) is less than that of females' (16.27%).

This study also found that the promotion rate of direct appointment and aviation training program officers is higher than that of officers from the military academies and ROTC. The study shows all of the above sources of commission are significant in the Logit regression model.

Officers who possess master and doctor degrees have higher promotion rates. This means that in the U.S. Military education level is still an important factor influencing O-4 promotion.

Generally speaking, the earlier an officer enters the military, the more military experiences he will have. This experience will help him to be more easily promoted. The results of the study the age of entering military is a significant factor in Logit model on promotion. But from the result of the promotion rate by each age (17 to 35) in Chapter III, Table 9 it can be seen that it is not true that the earlier you enter the military, the greater chance you will be promoted.

The promotion rate of white officers is 14.36 percent, a little greater than the promotion rate for black officers (13.73%). It is consistent with the reference cited in Chapter II in section on outside employment opportunities. The model indicates that minority members will be promoted as quickly as the majority members. From the Logit model, the promotion rate of Black Officers is not statistically different than the promotion rate of whites.

Loren M. Solnick found that graduates of black colleges start with higher salaries, but receive smaller wage increases and fewer promotions. This research finds a positive coefficient for attending a HBCU, though this finding is not significant in the Logit model. However, we noticed that the sample of individuals attending a HBCU is very small. In view of the preceding conclusions the following recommendations are offered.

B. RECOMMENDATIONS

- This thesis employed the 1983 cohort data. The data period is from 1983 to 1994. Officers who had not been promoted to O-4 in 1994 may still have opportunities for promotion to O-4 and are still in the promotion zone. The dependent variable (PROM) of this regression model is missing from many entries of the cohort. I recommend that future research use

earlier cohort data to do the advanced research of promotion rate.

- DMDC can only provide the college file data after 1991. This has restricted the scope of this thesis. The lack of data from 1983 to 1991 may result in a large bias when the college file is merged with earlier cohort data. (This resulted in the factor of the frequency of missing values because the merged file cannot be merged one by one). For this reason, in the second part of the thesis dealing with HBCU, there are only 7718 observations on the sample. Only 119 observation college attending are HBCU. I recommend using earlier college files from another data center to increase the sample of individuals who attended a HBCU.
- Increasing the number of black officers is a stated policy goal of the U.S. Navy. I recommend further research into the performance of HBCU graduates in the U.S. Navy. If graduates of HBCU's perform as well or better than graduates of other colleges and universities this may imply that the U.S. Navy step up its recruiting efforts at HBCU's.

APPENDIX A. HISTORICALLY BLACK COLLEGES

Alabama

Alabama A&M University
Alabama State University
Bishop State Junior College
Carver State Technical College
Concordia College
J.F. Drake State Technical College
Lawson State Community College
Miles College
Oakwood College
Selma University
Stillman College
Talladega College
Trenholm State Technical College
Tuskegee University

Arkansas

Arkansas Baptist College
Philander Smith College
Shorter College
University of Arkansas at Pine Bluff

Delaware

Delaware State College

District of Columbia

Howard University
University of the District of Columbia

Florida

Bethune Cookman College
Edward Waters College
Florida A&M University
Florida Memorial College

Georgia

Albany State College
Clark Atlanta University
Fort Valley State College
Morehouse College
Morris Brown College
Paine College
Savannah State College
Spelman College

Kentucky

Kentucky State University

Louisiana

Dillard University
Grambling State University
Southern University A&M College
Southern University/New Orleans
Southern University/Shreveport
Xavier University

Maryland

Bowie State University
Coppin State College
Morgan State University
University of Maryland Eastern Shore

Michigan

Lewis College of Business

Mississippi

Alcorn State University
Coahoma Community College
Hinds Community College
Jackson State University
Mary Holmes College
Mississippi Valley State University
Rust College
Tougaloo College

Missouri

Harris Stowe State College
Lincoln University

North Carolina

Barber-Scotia College
Bennett College
Elizabeth City State University
Fayetteville State University
Johnson C. Smith University
Livingstone College
North Carolina Agricultural and Technical State University
North Carolina Central University
St. Augustine's College
Shaw University
Winston-Salem State University

Ohio

Central State University
Wilberforce University

Oklahoma

Langston University

Pennsylvania

Cheyney University of Pennsylvania
Lincoln University

South Carolina

Allen University
Benedict College
Claflin College
Clinton Junior College
Denmark Technical College
Morris College
South Carolina State College
Voorhees College

Tennessee

Fisk University
Knoxville College
Lane College
Lemoyne-Owen College
Tennessee State University

Texas

Huston-Tillotston College
Jarvis Christian College
Paul Quinn College/Dallas
Paul Quinn College/Waco
Prairie View A&M University
St. Philip's College
Southwestern Christian College
Texas College
Texas Southern University
Wiley College

U.S. Virgin Islands

University of the Virgin Islands

Virginia

Hampton University
Norfolk State University
Virginia State University
St. Paul's College
Virginia Union University

West Virginia

West Virginia State College
Bluefield State College

APPENDIX B. PROGRAM LISTING-COHORT FILE

```
//FINAL JOB USER=S2571,CLASS=H
//   EXEC SASBIG
//COHORT83 DD DISP=SHR,DSN=MSS.F3893.COHOFF83
//SYSIN DD *
OPTIONS LINESIZE=80 PAGESIZE=60 NODATE ;

DATA ONE;
SET  COHORT83.COHOFF83(READ=CHRISTIE);

IF PG83 NE 21 THEN DELETE;
IF SEX83=0 THEN DELETE;
IF RACE83=0 THEN DELETE;
IF SOC83=0 THEN DELETE;

IF SEX83=1 THEN MALE=1; ELSE MALE=0;
IF SEX83=2 THEN FEMALE=1; ELSE FEMALE=0;

IF SOC83 IN (1 2 3 4 5 6 7) THEN ACADEMY=1 ; ELSE ACADEMY=0;
IF SOC83 IN ( 8 9 ) THEN ROTC=1; ELSE ROTC=0;
IF SOC83=10 THEN OCS=1; ELSE OCS=0;
IF SOC83 IN (13 14) THEN DIRAPPT=1; ELSE DIRAPPT=0;
IF SOC83=15 THEN AVTRPRG=1; ELSE AVTRPRG=0;

IF RACE83=1 THEN WHITE=1; ELSE WHITE=0;
IF RACE83=2 THEN BLACK=1; ELSE BLACK=0;
IF RACE83=3 THEN OTHERACE=1; ELSE OTHERACE=0;

ARRAY EDUC_LEV{13} EDLEV83 EDLEV84 EDLEV85
                   EDLEV86 EDLEV87 EDLEV88 EDLEV89 EDLEV90
EDLEV91
```

```
                    EDLEV92 EDLEV93 EDLEV94 EDLEV_L;
COLLEGE=0;
MASTER=0;
DOCTOR=0;
DO I=1 TO 13;
IF EDUC_LEV{I} LE 10   THEN COLLEGE=1;
ELSE IF EDUC_LEV{I}=11 THEN MASTER=1;
ELSE IF EDUC_LEV{I}=12 THEN DOCTOR=1;
END;

E_AGE=AAE83;

IF PG90=24 OR PG91=24 OR PG92=24 OR PG93=24 OR PG94=24 OR
  (PG_L=24 AND (PG90=24 OR PG91=24 OR PG92=24 OR PG93=24 OR
PG94=24 ))
THEN PROM=0; ELSE PROM=1;

LABEL MALE='MALE'
      FEMALE='FEMALE'
      ACADEMY='SOURCE OF COMMISSION FROM MILITARY SCHOOL'
      ROTC='RESERVE OFFICER TRAINING CORPS (SCHOLARSHIP OR
NON-SCHOLARSHIP'
      OCS='OFFICER CANDIDATE SCHOOL'
      AVTRPRG='AVIATION TRAINING PROGRAM'
      DIRAPPT='DIRECT APPOINTMENT PROF AND NON PROF'
      WHITE='RACE: WHITE PEOPLE'
      BLACK='RACE:BLACK PEOPLE'
         OTHERACE='HISPANIC, AMERICAN INDIAN, ASIAN/PACIFIC
ISLANDER'
      COLLEGE='BACHELORS DEGREE'
      MASTER='MASTERS DEGREE'
      DOCTOR='DOCTORATE AND FIRST-PROFESSIONAL DEGREE'
```

```
      E_AGE='AGE AT ENTRY'
      PROM='FROM O1 TO O4 OFFICER FROM 1983 THROUGH 1994'
      ;
PROC MEANS;
VAR  MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE BLACK
OTHERACE
     COLLEGE MASTER DOCTOR E_AGE PROM

PROC FREQ;
TABLES MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE
BLACK OTHERACE
       MASTER DOCTOR E_AGE PROM

  MALE*(ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE BLACK OTHERACE
       MASTER DOCTOR E_AGE PROM)

   FEMALE*(ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE BLACK
OTHERACE
       MASTER DOCTOR E_AGE PROM)

  BLACK*(MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT OTHERACE
       MASTER DOCTOR E_AGE PROM)

  WHITE*(MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT OTHERACE
       MASTER DOCTOR E_AGE PROM)

  OTHERACE*(MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT
OTHERACE
           MASTER DOCTOR E_AGE PROM)

   PROM*(MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE
BLACK OTHERACE
```

```
        COLLEGE MASTER DOCTOR E_AGE );

DATA ELEVEN;
INPUT  FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK OTHERACE
       MASTER E_AGE;
KEEPME=1;
CARDS;
0 0 0 0 0 0 0 0 22.15
1 0 0 0 0 0 0 0 22.15
0 1 0 0 0 0 0 0 22.15
0 0 1 0 0 0 0 0 22.15
0 0 0 1 0 0 0 0 22.15
0 0 0 0 1 0 0 0 22.15
0 0 0 0 0 1 0 0 22.15
0 0 0 0 0 0 1 0 22.15
0 0 0 0 0 0 0 1 22.15
0 0 0 0 0 0 0 0 23.15
;
DATA TWELVE;
     SET ELEVEN ONE;
PROC LOGISTIC;
MODEL PROM=FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK OTHERACE
           MASTER E_AGE /CTABLE;

OUTPUT OUT=MARGPROB P=YHAT;
DATA THIRTEEN;
     SET MARGPROB;
IF KEEPME=1;
PROC PRINT;
VAR YHAT   FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK OTHERACE
           MASTER E_AGE ;
TITLE'PREDICTED PROBABILITIES';
```

```
//
/*
```

APPENDIX C. PROGRAM LISTING-COLLEGE MERGE COHORT

```
//MERGE83 JOB USER=S2571,CLASS=H
//   EXEC SASBIG
//COLLEGE DD DISP=SHR,DSN=MSS.SIS34.COLLEGE
//COHOFF83 DD DISP=SHR,DSN=MSS.F3893.COHOFF83
//COHORTBR DD DISP=(NEW,CATLG),UNIT=SYSDA,
//          SPACE=(CYL,(30,10),RLSE),
//          DSN=MSS.S2571.HBC83
//SYSIN DD *
OPTIONS LINESIZE=80 PAGESIZE=60 NODATE ;
DATA COLLEGE;
     INFILE COLLEGE;
     INPUT @1 SSNMAST PIB4.
              ARMYCODE $  6-11
                AFCODE $ 12-14
              NAVYCODE $ 15-24;
    LABEL ARMYCODE = 'ARMY COLLEGE ATTENDED'
            AFCODE = 'AIR FORCE COLLEGE ATTENDED'
          NAVYCODE = 'NAVY COLLEGE ATTENDED';
PROC SORT; BY SSNMAST;
PROC SORT DATA=COHOFF83.COHOFF83 (READ=CHRISTIE) OUT=CBR; BY
SSNMAST;
DATA COHORTBR.COHORTBR;
     MERGE CBR (IN=KEEPME) COLLEGE ; BY SSNMAST;
IF KEEPME;
```

APPENDIX D. PROGRAM LISTING-MERGED FILES

```
//ARGUE JOB USER=S2571,CLASS=H
//   EXEC SASBIG
//TU      DD DISP=SHR,DSN=MSS.S2571.HBC83
//SYSIN DD *
OPTIONS LINESIZE=80 PAGESIZE=60 NODATE ;
DATA ONE;
SET TU.COHORTBR;

IF PG83 NE 21 THEN DELETE;
IF PG94=0 THEN DELETE;
IF RACE94=0 THEN DELETE;

 IF NAVYCODE IN:('ALABAM A&M' 'ALABAMA SU' 'ALBANY GA'
    'ALCORN MS' 'ALLEN U' 'BARBER SCO' 'BENEDICT' 'BENNETT NC'
    'BETHUNE CO' 'BLUFLD WVA' 'BOWIE MD' 'CHEYNEY PA'
    'CLAFLIN SC' 'CLARK ATL' 'COAHOMA MS' 'COPPIN MD'
    'DELAWARE S' 'DILLARD LA' 'ELZ CTY SU' 'FAYETTEVIL'
    'FISK TENN' 'FLA A&M' 'FLA MEMORL' 'FORT VALLE'
    'GRAMBLING' 'HAMPTON VA' 'HARRIS MO' 'HINDS MS' 'HOWARD
DC'
    'JACKSN MIS' 'JARVIS CH' 'KENTUCKY S' 'KNOXVILLE'
    'LANE TENN' 'LANGSTON' 'LAWSON CC' 'LEMOYNE-OW'
    'LINCOLN MO' 'LINCOLN PA' 'LIVNGST NC' 'MEHARRY'
    'MILES ALA' 'NC AG&TECH' 'NC CENT U' 'OAKWOOD'
    'PAINE GA' 'PRAIRIE TX' 'RUST MISS' 'S CAROL SC'
    'SAVANNAH' 'SHAW NC' 'SHORTER AR' 'SOUTHRN LA'
    'SPELMAN' 'ST AUGUSTI' 'ST PAUL V' 'STILLMAN'
    'TALLADEGA' 'TENN SU' 'TEXAS C' 'TEXAS SO U'
    'TOUGALOO' 'TUSKEGEE' 'U ARKANSAS' 'U MARYLAND'
    'VOORHEES' 'W VA STATE' 'WILBERFORC' 'WILEY TEX'
```

```
    'WINSTON SA' 'XAVIER LA') OR
AFCODE IN: ('AGB' 'ALD' 'ALJ' 'ALM' 'ALQ'
        'ALU' 'ARD' 'AUS' 'BAI' 'BEH' 'BEK'
        'BEZ' 'BLE' 'CEI' 'CLA' 'CMN' 'CNV'
        'CPH' 'DEB' 'DIC' 'ECH' 'FIC' 'FLD'
        'FLE' 'FOE' 'GRC' 'HAE' 'HAK' 'HDL'
        'HOQ' 'HUF' 'JAB' 'JAF' 'JOG' 'KED'
        'KNB' 'LAJ' 'LAK' 'LEE' 'LID' 'LIE'
        'LIH' 'MBP' 'MDA' 'MEF' 'MOI' 'MOJ'
        'MOL' 'MOM' 'MUL' 'NHF' 'NJC' 'NLL'
        'NOE' 'NOF' 'OAB' 'PAL' 'PAW' 'PHF'
        'PRA' 'RUB' 'SAI' 'SFA' 'SGA' 'SHA'
        'SHG' 'SOA' 'SPA' 'SQD' 'SQP' 'SRY'
        'STM' 'SXE' 'TAB' 'TED' 'TEI' 'TEL'
        'TOD' 'TUF' 'VCJ' 'VIF' 'VIH' 'WEM'
        'WGH' 'WIB' 'WIC' 'YAC' '032' ) OR
ARMYCODE IN:('001005' '001024' '001033' '001037' '001044'
  '001046'  '001050'  '001059'  '001087'  '001103'  '001105'
'001428'
  '001448'  '001467'  '001478'  '001480'  '001486'  '001544'
'001566'
  '001568'  '001582'  '001583'  '001587'  '001590'  '001591'
'001666'
  '001704'  '001968'  '002004'  '002006'  '002026'  '002032'
'002062'
  '002068'  '002083'  '002106'  '002139'  '002247'  '002289'
'002396'
  '002401'  '002407'  '002412'  '002424'  '002425'  '002433'
'002439'
  '002466'  '002479'  '002510'  '002528'  '002709'  '002748'
'002905'
```

```
  '002909'  '002911'  '002926'  '002928'  '002936'  '002942'
'002950'
  '002962'  '002968'  '002986'  '003026'  '003141'  '003144'
'003157'
  '003196'  '003290'  '003317'  '003417'  '003420'  '003424'
'003439'
  '003448'  '003455'  '003490'  '003497'  '003499'  '003501'
'003502'
  '003506'  '003522'  '003529'  '003548'  '003575'  '003577'
'003602'
  '003608'  '003618'  '003630'  '003637'  '003638'  '003642'
'003669'
  '003703'  '003714'  '003739'  '003764'  '003766'  '003809'
'003826'
 '003842' '003968' '004923' '005363' '006787' '006957'  )
THEN HBC =1;
 ELSE HBC=0;

IF SEX83=1 THEN MALE=1; ELSE MALE=0;
IF SEX83=2 THEN FEMALE=1; ELSE FEMALE=0;

IF SOC83 IN (1 2 3 4 5 6 7) THEN ACADEMY=1 ; ELSE ACADEMY=0;
IF SOC83 IN ( 8 9 ) THEN ROTC=1; ELSE ROTC=0;
IF SOC83=10 THEN OCS=1; ELSE OCS=0;
IF SOC83 IN (13 14) THEN DIRAPPT=1; ELSE DIRAPPT=0;
IF SOC83=15 THEN AVTRPRG=1; ELSE AVTRPRG=0;

IF RACE83=1 THEN WHITE=1; ELSE WHITE=0;
IF RACE83=2 THEN BLACK=1; ELSE BLACK=0;
IF RACE83=3 THEN OTHERACE=1; ELSE OTHERACE=0;

IF RACE94=2 AND HBC=1 THEN BHBC=1; ELSE BHBC=0;
```

```
IF RACE94=1 AND HBC=1 THEN WHBC=1; ELSE WHBC=0;
IF RACE94=3 AND HBC=1 THEN OHBC=1; ELSE OHBC=0;

ARRAY EDUC_LEV{13} EDLEV83 EDLEV84 EDLEV85
                   EDLEV86 EDLEV87 EDLEV88 EDLEV89 EDLEV90
EDLEV91
                  EDLEV92 EDLEV93 EDLEV94 EDLEV_L;
COLLEGE=0;
MASTER=0;
DOCTOR=0;
DO I=1 TO 13;
IF EDUC_LEV{I} LE 10   THEN COLLEGE=1;
ELSE IF EDUC_LEV{I}=11 THEN MASTER=1;
ELSE IF EDUC_LEV{I}=12 THEN DOCTOR=1;
END;

E_AGE=AAE83;

IF PG90=24 OR PG91=24 OR PG92=24 OR PG93=24 OR PG94=24 OR
  (PG_L=24 AND (PG90=24 OR PG91=24 OR PG92=24 OR PG93=24 OR
PG94=24 ))
THEN PROM=0; ELSE PROM=1;

LABEL MALE='MALE'
      FEMALE='FEMALE'
      ACADEMY='SOURCE OF COMMISSION FROM MILITARY SCHOOL'
      ROTC='RESERVE OFFICER TRAINING CORPS (SCHOLARSHIP OR
NON-SCHOLARSHIP'
      OCS='OFFICER CANDIDATE SCHOOL'
      AVTRPRG='AVIATION TRAINING PROGRAM'
      DIRAPPT='DIRECT APPOINTMENT PROF AND NON PROF'
      WHITE='RACE: WHITE PEOPLE'
```

```
      BLACK='RACE:BLACK PEOPLE'
         OTHERACE='HISPANIC, AMERICAN INDIAN, ASIAN/PACIFIC
ISLANDER'
      COLLEGE='BACHELORS DEGREE'
      MASTER='MASTERS DEGREE'
      DOCTOR='DOCTORATE AND FIRST-PROFESSIONAL DEGREE'
      E_AGE='AGE AT ENTRY'
      PROM='FROM O1 TO O4 OFFICER FROM 1983 THROUGH 1994'
      ;
PROC MEANS;
VAR  MALE FEMALE ACADEMY ROTC OCS AVTRPRG DIRAPPT WHITE BLACK
OTHERACE
     COLLEGE MASTER DOCTOR E_AGE PROM HBC;

PROC FREQ;
TABLES PROM *(HBC BHBC WHBC OHBC FEMALE ACADEMY ROTC
              AVTRPRG DIRAPPT WHITE BLACK OTHERACE
              MASTER E_AGE);

DATA ELEVEN;
INPUT  HBC FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK OTHERACE
       MASTER E_AGE;
KEEPME=1;
CARDS;
0 0 0 0 0 0 0 0 0 21.68
1 0 0 0 0 0 0 0 0 21.68
0 1 0 0 0 0 0 0 0 21.68
0 0 1 0 0 0 0 0 0 21.68
0 0 0 1 0 0 0 0 0 21.68
0 0 0 0 1 0 0 0 0 21.68
0 0 0 0 0 1 0 0 0 21.68
0 0 0 0 0 0 1 0 0 21.68
```

```
0 0 0 0 0 0 0 1 0 21.68
0 0 0 0 0 0 0 0 1 21.68
0 0 0 0 0 0 0 0 0 22.68
;
DATA TWELVE;
     SET ELEVEN ONE;
PROC LOGISTIC;
MODEL PROM=HBC FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK
OTHERACE
           MASTER E_AGE ;

OUTPUT OUT=MARGPROB P=YHAT;
DATA THIRTEEN;
     SET_MARGPROB;
IF KEEPME=1;
PROC PRINT;
VAR YHAT    HBC FEMALE ACADEMY ROTC AVTRPRG DIRAPPT BLACK
OTHERACE
           MASTER E_AGE ;
TITLE'PREDICTED PROBABILITIES';
//
/*
```

APPENDIX E. THE LOGISTIC PROCEDURE

CLASSIFICATION TABLE

	Correct		Incorrect		Percentages				
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	False POS	False NEG
0.020	2357	0	14163	0	14.3	100.0	0.0	85.7	.
0.040	2357	1	14162	0	14.3	100.0	0.0	85.7	0.0
0.060	2351	179	13984	6	15.3	99.7	1.3	85.6	3.2
0.080	2159	1744	12419	198	23.6	91.6	12.3	85.2	10.2
0.100	1465	8621	5542	892	61.1	62.2	60.9	79.1	9.4
0.120	1389	9438	4725	968	65.5	58.9	66.6	77.3	9.3
0.140	1386	9468	4695	971	65.7	58.8	66.9	77.2	9.3
0.160	1371	9564	4599	986	66.2	58.2	67.5	77.0	9.3
0.180	1267	10186	3977	1090	69.3	53.8	71.9	75.8	9.7
0.200	1190	10725	3438	1167	72.1	50.5	75.7	74.3	9.8
0.220	1052	11441	2722	1305	75.6	44.6	80.8	72.1	10.2
0.240	859	12115	2048	1498	78.5	36.4	85.5	70.5	11.0
0.260	223	13697	466	2134	84.3	9.5	96.7	67.6	13.5
0.280	164	13974	189	2193	85.6	7.0	98.7	53.5	13.6
0.300	154	14009	154	2203	85.7	6.5	98.9	50.0	13.6
0.320	149	14016	147	2208	85.7	6.3	99.0	49.7	13.6
0.340	143	14016	147	2214	85.7	6.1	99.0	50.7	13.6
0.360	141	14020	143	2216	85.7	6.0	99.0	50.4	13.6
0.380	128	14034	129	2229	85.7	5.4	99.1	50.2	13.7
0.400	64	14077	86	2293	85.6	2.7	99.4	57.3	14.0
0.420	32	14121	42	2325	85.7	1.4	99.7	56.8	14.1
0.440	15	14150	13	2342	85.7	0.6	99.9	46.4	14.2
0.460	4	14158	5	2353	85.7	0.2	100.0	55.6	14.3
0.480	0	14161	2	2357	85.7	0.0	100.0	100.0	14.3
0.500	0	14163	0	2357	85.7	0.0	100.0	.	14.3

LIST OF REFERENCES

1. *American Universities and Colleges*, 14th edition.

2. Lehner, J. Christopher, JR, *A Losing Battle: the Decline in Black Participation in Graduate and Professional Education*, National Advisory Committee on Black Higher Education and Black Colleges and Universities, October, 1980.

3. Foner Jack D., *Black and the Military in American History*, New York: Praeger Publisher, 1974.

4. Hill, Susan T., *The Traditionally Black Institutions of Higher Education 1860-1982*, Washington, D.C.: National Center for Education Statistics, 1985.

5. National Survey of the Higher Education of Negroes Federal Security Agency, U.S. Office of Education, Washington, D.C.: U.S. Government Printing Office, Volume I, 1942.

6. Brown, Luther, "Recruits at HBCUS" *Black Enterprise*, October 1992, p. 29.

7. Conrad, Cecilia, "College Grads and Affirmative Action," *Black Enterprise*, September 1995, p. 24.

8. Constantine, Jill M., "The Effect of Attending Historically Black Colleges and Universities on Future Wages of Black Students," *Industrial & Labor Relations Review* Vol. 48, No. 3, April 1995, pp. 531-546.

9. Solnick, Loren M.,"Black College Attendance and Job Success of Black College Graduates," *Economics of Education Review*, Vol. 9 No. 2, 1990, pp. 135-148.

10. Lux, John E., "The Effects of Military Drawdown on Recruiting of Recruiting of Minority Officers," Thesis, Naval Postgraduate School, March 1995.

11. Northrup, Herbert R., John A. Brinker, Steven M. Diantonio and Dale F. Daniel, *Black and Other Minority Participation in the All-Volunteer Navy and Marine Corps*, Philadelphia: Industrial Research Unit, Wharton School University of Pennsylvania, 1979.

12. Simpson, Peggy F., "Promotion Opportunities of Minorities to the Controlled Grades in the Navy Nurse Corps," Thesis, Naval Postgraduate School, December, 1992.

13. Gujarati, Damodar N., *Basic Econometrics,* New York: McGraw-Hill, 1995, pp. 554-555.

BIBLIOGRAPHY

Afifi, A.A.and Virginia Clark, *Computer - Aided Multivariate Analysis*, New York: Chapman & Hall, 1990.

Associated Press "Report on Military Finds Disparities in Promotion Rates of Blacks, Women", *Washington Times*, Nov 21, 1995, p. 7.

Astin, Alexander W., *Predicting Academic Performance in College*, New York: Free Press, 1971.

Greer, Roosevelt, *HBCUs as a Major Source of Black Officers in the Armed Forces*, (Washington, D.C.: Industrial College of the Armed Forces - National Defense University, 1986), p. 5.

Gurin, Patricia, *Black Consciousness, Identity, and Achievement*, New York: John Wiley & Sons, 1975.

MacGregor, Morris J., Jr., *Integration of the Armed Forces 1940-1965, Defense Studies Series*, Center of Military History, U.S. Army, Washington, D.C., 1981.

U.S. Department of Defense, Office of the Deputy Assistant Secretary of Defense for Equal Opportunity and Safety Policy, *Black Americans in Defense of Our Nation*, January, 1985.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Navy Manpower Analysis Center Code 531 NAS Memphis 5820 Navy Road Millington, TN 38054-5056	2
2.	Defense Technical Information Center 8725 Kingman Rd., STE 0944 Ft. Belvoir, VA 22060-6218	2
3.	Dudley Knox Library Naval Postgraduate School 411 Dyer Rd. Monterey, CA 93943-5101	2
4.	Professor Natalie J. Webb Code SM/We Naval Postgraduate School Monterey, CA 93943-5000	1
5.	Professor Mike Cook Code SM/Cm Naval Postgraduate School Monterey, CA 93943-5000	1
6.	Major Tu, Li-Wei 6F, 3, LN47 Rose Road, Hsintein Taipei, Taiwan	2
7.	Ms. Yang Hui-Ying 6F, 3, LN47 Rose Road, Hsintein Taipei, Taiwan	1